Discussion Paper **Document de travail**

The Wage Determination Process in Canadian Manufacturing Industries 1962-1975

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Central Analytical Services Branch

Direction d'analyse économique
Direction centrale des services analytiques

Labour Canada
Travail Canada

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PREFACE

The recently created Economic Analysis Directorate, Central Analytical Services Branch of Labour Canada, regularly undertakes and commissions research and analysis in the field of labour economics and industrial relations in order to bring this understanding to bear on the development and evaluation of the programs of Labour Canada and on the economic policy initiatives of the federal government. We are pleased that Dr. David Wilton's study, The Wage Determination Process in Canadian Manufacturing Industries, 1962-1975, is the first in a series of Discussion Papers reporting on the nature and findings of this research and analysis. As a matter of practice these Discussion Papers, which are directed to practioners and specialists in the field of labour economics and industrial relations, will be published in the official language of the author. An abstract will be published in both official languages.

It is particularly appropriate that the inaugural paper in this series should be authored by Dr. Wilton, one of Canada's most respected and prolific researchers in the area of wage determination. Dr. Wilton, currently Associate Professor of Economics at the University of Guelph, formerly was associated with Health and Welfare Canada, Statistics Canada and Queen's University. His university training was at the Massachussett's Institute of Technology and McMaster University.

Mr. Allan Porter of the Economic Analysis Directorate was responsible for the development of the wage chronologies which form the data base for this study, and contributed to the analysis. Miss Margo Desmarais provided valuable technical assistance in the preparation of the wage chronology data base.

While Dr. Wilton's work was undertaken under the auspices of Labour Canada, the views expressed in it are his own and do not necessarily reflect those of Labour Canada or the Government of Canada.

Trent Gow,
Director,
Economic Analysis Directorate.

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Hull, Quebec
April 1977

PREFACE

La nouvelle Direction de l'analyse économique au sein de la Direction générale des services centraux d'analyse de Travail Canada effectue ou fait effectuer périodiquement des travaux de recherche et d'analyse dans le domaine de l'économie du travail et des relations industrielles, afin que ces travaux puissent servir d'auxiliaires pour l'élaboration et l'évaluation des programmes de Travail Canada et pour les initiatives du gouvernement fédéral en matière de politique économique. Nous sommes heureux que l'étude de M. David Wilton, The Wage Determination Process in Canadian Manufacturing Industries, 1962-1975, soit le premier d'une série de Documents de travail qui décriront la nature et exposeront les conclusions de ces travaux de recherche et d'analyse. Ces documents de travail s'adressent aux spécialistes comme aux non spécialistes dans le domaine de l'économie du travail et des relations industrielles et ils seront publiés normalement dans la langue officielle de leur auteur. Un exposé sommaire sera publié dans les deux langues officielles du pays.

Il est particulièrement approprié que l'auteur du premier document de cette série soit M. Wilton, l'un des chercheurs les plus dynamiques et réputés au Canada dans le domaine de la fixation des salaires. M. Wilton, qui est présentement professeur agrégé d'économie à l'Université de Guelph, a travaillé dans le passé pour Santé et Bien-être social Canada, Statistique Canada et l'Université Queen's. Il a reçu sa formation universitaire à l'Institut de technologie du Massachussetts et à l'Université McMaster.

M. Allan Porter, de la Direction de l'analyse économique, était chargé de la mise au point des données chronologiques sur les salaires qui constituent la base de cette étude, et il a participé au travail d'analyse. Mlle Margo Desmarais a apporté une aide technique précieuse pour la préparation du fichier de base relatif aux données chronologiques sur les salaires.

Bien que le travail de M. Wilton ait été effectué sous les auspices de Travail Canada, les vues qui s'y trouvent exprimées sont les siennes et ne reflètent pas nécessairement celles de Travail Canada ou du Gouvernement du Canada.

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ABSTRACT

In this study the author re-examines the relationship of negotiated wage changes to demand and supply conditions in the labour market (commonly known as the "Phillip's curve" or the inflation and employment trade-off curve). Because of deficiencies in conventional time series data for the economy as a whole, the author uses a sample of 1190 individual wage settlements in Canadian manufacturing industries for the period 1962-1975.

Although the author finds that the Phillip's curve has existed in Canada during the last decade, he concludes that this Phillip's curve is rather discouraging for policy makers who attempt to manage the economy through monetary and fiscal policies. In the short run, the Phillip's curve is "very flat", suggesting that conventional monetary and fiscal policies can have only modest effects on inflation by changing output and unemployment rates. However, in the long run the Phillip's curve is "virtually vertical" at an intolerably high rate of unemployment. This suggests, in the long run, that monetary and fiscal policies will not succeed in trading-off higher prices for less unemployment. The author also finds that a help wanted index (a measure of job vacancies) is a preferable measure of labour market conditions than is the unemployment rate. Given fundamental changes in the Canadian labour market during the 1970's (as reflected in a vastly different relationship between unemployment and vacancy rates), the Canadian Phillip's curve has shifted dramatically to a much higher and more adverse position.

Finally, the paper provides evidence with respect to two additional hypotheses: Wage "catch up" has been a significant factor in Canadian wage settlements during the 1960's and 1970's and quantitatively more important than expectations of price increases. It is not expectations of rising prices which appear to be the important determinant of wage settlements, but rather what has happened to prices in the period before collective bargaining.

As well, wage "spillovers" are a significant factor in determinining wages. Almost one half of a particular wage settlement can be attributed to spillovers from other wage settlements. From a policy perspective, these wage spillovers introduce a crucial interdependency in the wage system. This interdependency suggests that any change in policy will take longer to affect the level of wage settlements since "historical relationships" are a key ingredient.

SOMMAIRE

Dans la présente étude, l'auteur réexamine le rapport des changements apportés aux salaires par voie de négociation avec la situation de l'offre et de la demande sur le marché du travail (connu sous le nom de "courbe Phillip" ou courbe d'échange de l'inflation et du chômage). A cause de l'insuffisance des données des séries temporelles conventionnelles, l'auteur se sert d'un échantillonnage de 1190 ententes salariales conclues dans les industries manufacturières au Canada pour la période allant de 1962 à 1975.

L'auteur constate que la courbe Phillip a été employée au Canada au cours de la dernière décennie, mais il en déduit qu'elle est plutôt décourageante pour les décisionnaires qui cherchent à diriger l'économie par voie de politiques monétaires et fiscales. A brève échéance, la courbe Phillip est très aplatie, ce qui fait dire que les politiques monétaires et fiscales traditionnelles ne peuvent avoir que très peu d'influence sur l'inflation en changeant le rendement et le taux de chômage. A la longue, cependant, la courbe Phillip est pour ainsi dire verticale lorsque le chômage atteint un sommet inadmissible. Ce qui veut dire que, à la longue, les politiques monétaires et fiscales ne réussissent pas à échanger des prix plus élevés pour moins de chômage. L'auteur trouve également que l'indice des emplois demandés (mesure de postes vacants) est une mesure de la situation du marché du travail préférable au taux de chômage. Etant donné les changements fondamentaux qui se sont produits sur le marché du travail au Canada au cours des années 1970 (comme le traduit la grande différence du rapport entre le taux de chômage et le nombre de postes vacants), la courbe Phillip au Canada a atteint un niveau beaucoup plus élevé et plus défavorable.

Selon l'auteur, il y a deux hypothèses: le rattrapage des salaires a été un facteur important dans les ententes salariales au Canada au cours des années 1960 et 1970 et quantativement plus important que les hausses des prix auxquelles on s'attendait. Ce ne sont pas les perspectives de la hausse des prix qui semblent être l'élément déterminant important des ententes salariales, mais plutôt ce qui est arrivé aux prix au cours de la période qui a précédé les négociations collectives.

Les effets d'entraînement de salaires, de même, sont un facteur important dans la fixation des salaires. Près de la moitié de l'augmentation accordée dans une entente salariale particulière peut être attribuée aux effets d'entraînement provenant d'autres ententes salariales. Considérant les politiques, ces effets d'entraînement des salaires introduisent une interdépendance cruciale dans le salariat. Cette interdépendance laisse entendre que tout changement apporté à la politique tardera davantage à influer sur le niveau des ententes salariales, vu que les "rapports historiques" sont un élément clé.

THE WAGE DETERMINATION PROCESS IN CANADIAN MANUFACTURING INDUSTRIES, 1962-1975

I. INTRODUCTION

Almost twenty years have passed since A. W. Phillips (1958) first presented empirical evidence to support the proposition that "the rate of change of money wage rates can be explained by the level of unemployment". Phillips' seminal paper provided an important stimulus to the exploration of the wage determination process, and simple variants of the Phillips trade-off curve were quickly assimilated into the body of widely-accepted economic propositions.

> "On the usual time scale of the dissemination of ideas in economics, the Phillips curve and the associated 'Dilemma' problem achieved a prominent place in undergraduate textbooks almost instantly ..... the deja vu reaction was so strong that the Phillips curve immediately achieved a life of its own in professional discussion ..."
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> Leijonhufvud (1968), p. 738

The Canadian "conversion" to the Phillips curve concept was typical of the world-wide acceptance of this new policy constraint (the "trade-off"). Numerous studies established the existence of a Canadian Phillips curve, although the particular form of the Canadian trade-off curve was certainly not invariant to author nor time period.[1] Buttressed by these empirical studies purporting to have found the Canadian Phillips curve, government policy quickly moved to exploit the political advantages of the trade-off curve. A government could <u>not</u> be expected to lower <u>simultaneously</u> both inflation and unemployment (the government must choose its poison). The notion of a "trade-off" was quickly incorporated into

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[1] See, for example, Bodkin et al (1966), Kaliski (1964 and 1972), Reuber (1970), Vanderkamp (1966 and 1972) and Zaidi (1969).

the politician's lexicon, and became a popular explanation for all manner of social evils.

Unfortunately in recent years Canada has experienced high levels of both inflation and unemployment. The simple trade-off theory predicts only one evil (not two). Not surprisingly, empirical estimates for Canadian Phillips curves began to deteriorate. For example, Kaliski (1972) found that "the original wage change equations (of Bodkin et al., 1966) no longer seem to fit the data very satisfactorily" when the time period was extended from 1965 to 1969.[1] A further indication of the demise of the Canadian Phillips curve is the absence of published studies which include the last five to ten years of data. Since "negative results" rarely find their way into print, the "golden age of Phillips curves" (the first decade after Phillips' original paper) appears to have been followed by a decade of empirical (and theoretical) agnosticism.

Before discussing a number of reasons which might account for this deterioration in empirical wage estimates, it is important to re-emphasize the pivotal role that a Phillips curve plays in macroeconomic policy formulation. Most economists would argue that changes in monetary and/or fiscal policy can affect the level of aggregate demand and (consequently) employment/unemployment rates. However, as the government exercises demand management policies to reduce unemployment, prices and wages will likely start to rise at faster rates. The principal mechanism

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[1] For example, in "corrected" Table 2.4 (Kaliski, 1972) not once does the unemployment variable pass an .05 significance test and twice it has the "wrong" sign.

which generates this "added" inflation is the Phillips curve. Wages are"bid up"as unemployment declines, and prices are assumed to be "marked-up" (labour) costs.[1] If one were to jettison the Phillips curve from one's theoretical macroeconomic model, one loses the connecting link between the real sector (employment and output) and prices. In such a "non-Phillips curve" world, the government could pursue a fiscal policy of (almost) full employment without worrying about inflation as there is no causal structural link between lower rates of unemployment and higher rates of inflation. Thus, from a demand management policy perspective, the Phillips curve is the rationale for not pursuing policies which would lower unemployment to a minimum frictional level. Consequently, the empirical validity of the Phillips curve is of crucial policy importance.

Furthermore, only empirical studies can establish the "position" and "steepness" of the Phillips curve. It is the slope of the Phillips curve which determines how much extra inflation must be tolerated for a lower unemployment rate. For example, if the Phillips curve was quite flat, then a sizeable increase in the unemployment rate would be required to moderate inflation. The steeper the Phillips curve, the greater leverage that demand management policies can exercise on the inflation rate.

I now return to examine briefly why Phillips curves estimates may have deteriorated in recent years. First, in several studies,

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[1] It is also possible that "excess" demand in the product market might push up prices directly (irrespective of costs), but economists have found very little empirical evidence of such "direct" excess demand effects.

J. C. R. Rowley and D. A. Wilton have argued that the significance levels of most of these "early" estimates of Phillips curves were misleading due to the presence of a substantial amount of "inherent" autocorrelation in the error term (given the particular choice of functional form, an overlapping annual change based on quarterly data). "Our efficient estimates for the wage equations presented by Bodkin et al, Kaliski, and Helliwell et al. indicate that there is not a statistically significant relationship between wage changes and movements in unemployment" (1974a, p. 250-251). In short, the use of an inefficient estimator (least squares) for a particular specification of the wage-change model may have created the "statistical illusion" of a Phillips curve when in fact it never really existed!

A second major econometric problem encountered in estimating Phillips curves is the role of the union. First, one must dispose of a popular myth. The fact that union membership constitutes only about 30% of the labour force is largely irrelevant to the issue. Nearly all existing Canadian Phillips curves are estimated using data based on production workers in the manufacturing sector (or sometimes the industrial composite). In the manufacturing sector, union members account for over 70% of the production work force, and cannot be ignored. From an econometric perspective, a number of institutional (union) features of the labour market can seriously bias the statistical results if not adequately represented in the model. First, and most obvious, unions typically sign multi-year contracts with "locked-in" increments. During the 1955-1968 period, the average contract length in Canadian manufacturing industries rose from 17.2 months to 28.9 months.[1] Since future "locked-in" raises are determined at the time the contract is signed, explanatory

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[1] For complete details on contract length and other institutional features of the Canadian labour market, see the forthcoming monograph by J. C. R. Rowley and D. A. Wilton, The Determination of Wage-Change Relationships, 1977 (Chapter 4).

variables must be appropriately dated so that when the "locked-in" raise occurs (say two years after the contract was signed), the explanatory variables correctly reflect economic conditions at the time of the contract (two years ago) and not economic conditions at the time when the locked-in raise becomes effective. In addition, one must correctly specify front-end loading features of these contracts and a set of weights to reflect the bargaining calendar.[1] In short, the correct temporal specification of explanatory variables is exceedingly difficult and failure to specify correctly these institutional features can seriously bias the estimates of a Phillips curve.[2] An attempt to incorporate these critical institutional union features into a time-series, wage determination model failed to resurrect a Phillips curve in Canada.[3] However, it is not at all clear, given the difficulties associated with these institutional features, that time-series data is the appropriate medium for analysis.

Finally, the "application" of the Phillips curve theory may be incorrect. As discussed in this paper, conventional Phillips curve theory may have to be modified substantially to accomodate the essential institutional features of the labour market (such features as "recontracting"). In addition, the "quantification" of specific theoretical variables may be inappropriate. For example, the unemployment rate may no longer be an appropriate indicator of excess supply in the labour market. The Economic Council of Canada, in its large study of the Canadian labour market, con-

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[1] The bargaining calendar is not uniformly spread over all months, but has an annual and seasonal "bunching" pattern.

[2] See Rowley and Wilton (1974b).

[3] See Rowley and Wilton (1974a).

cluded that

> "Basic changes in the labour market have rendered the message of the unemployment rate today rather different from that of a decade ago. From our examination of it and other measurements, we believe that the aggregate rate alone is an incomplete indicator of idle labour capacity..." p. 211

Thus, if our empirical construct (the unemployment rate) is a poor proxy for the underlying theoretical variable (excess labour supply), then we should not expect to obtain precise estimates of a Phillips curve.

The purpose of this study is to re-examine the question of whether a Phillips curve has existed in Canada during the last decade; and, if so, what are the important characteristics of the Canadian Phillips curve? In other words, can Canada significantly moderate wage inflation by accepting higher rates of unemployment? To answer these important policy questions, one must first isolate the major economic explanatory factors in the wage determination process.

The point of departure for this study is the use of "micro" data for 1190 individual wage settlements within the Canadian manufacturing sector during the 1962-1975 (pre A.I.B.) period. As pointed out above, most Phillips curve research has focussed on the manufacturing sector, a sector which is predominantly unionized. Given the institutional features of varying contract lengths, front-end loading and a seasonal bargaining calendar, traditional time-series analysis is exceedingly complex. To overcome this problem, each wage settlement is treated as an individual observation with no aggregation up to quarterly time-series data. This "micro" methodology has previously been employed by Hamermesh (1970) and Sparks and Wilton (1971), although in each case the sample size is only about one sixth the size of that used in this study and the specification of explanatory variables is quite different.

The data employed in the study were constructed by the Department of Labour in the form of wage chronologies for a number of industries within the Canadian manufacturing sector. A list of these industries, and the number of contracts for each industry, is given in Table 1. For each contract the total percentage change in the wage rate is expressed in annual terms, i.e. normalized by the length of contract. The wage rate concept is the "base wage rate", a superior concept to average hourly earning since it does not include extraneous elements such as overtime premiums and changes in employment mix. Finally, all contracts with cost-of-living clauses (COLA) are excluded from this study given the diversity of the COLA features (e.g. different formulas, "caps", "triggers", etc.).

Section II of this study provides estimates of a "conventional" Phillips curve for the Canadian manufacturing sector. Given the empirical deficiencies of such conventional Phillips curve estimates, section III is devoted to a re-assessment of the conventional price expectations model in the context of the union-firm wage contracting process. In section IV the role of "other wage settlements" (spillovers) is examined. The final section of the paper summarizes the policy implications of the "best" wage equations presented, with particular emphasis on the nature of the wage inflation - unemployment trade-off facing Canada.

TABLE 1

INDUSTRIES REPRESENTED

Meat Products	32
Beverages	180
Rubber Products	54
Pulp and Paper Mills	152
Iron and Steel Mills	36
Transportation Equipment and Agricultural Implements	68
Major Electrical Appliances	108
Glass Products	50
Petroleum Refineries	177
Chemical Products	333
Total	1,190

II. THE CONVENTIONAL PHILLIPS CURVE

The proposition that the price of a commodity will rise (fall) if there is "excess" demand (supply) for it is as old as economics. Phillips was the first economist to popularize this notion with respect to the price of labour. An excess demand for labour could be expected to increase wage rates as firms competitively bid for scarce labour. Phillips argued that the unemployment rate was a suitable proxy for excess supply of labour and found a strong negative relationship between wage changes and unemployment in the U.K. over the 1861-1957 period. As mentioned above, a number of "time-series" studies provided estimates for a "Phillips" curve in Canada, although such Phillips curve estimates have seriously deteriorated in recent years.

One possible explanation for the failure to detect a Phillips curve in recent years is the fact that the Canadian unemployment rate may no longer be a satisfactory proxy for excess demand/supply in the labour market. As Green and Cousineau (1976) point out, the composition of the unemployed pool has changed substantially since 1961:

> "The most remarkable feature ... is the decline in the percentage of the unemployed who are "heads" of families. (from 46% in 1961 to 33% in 1974) ... Since 1961, ... the percentage of families with at least one unemployed person and no persons employed has declined substantially (45% to 33%)..... The changes in the composition of the unemployed suggest the increasingly important role of secondary workers and multi-earner families in the unemployment picture. The traditional picture of the unemployed worker as a prime aged male and the "unemployed family" as one without any current earnings is apparently a less reliable picture in fact." p. 27-28

Whether one should attribute these fundamental changes in the labour force and unemployed pool to underlying demographic trends or to improvements in

unemployment insurance benefits (which substantially reduced the "cost" of being unemployed and perhaps attracted new members to the labour force) is a moot point. For whatever reasons, the composition of the unemployed pool has shifted toward "secondary" workers, workers who have potentially less attachment to the labour force. Such a compositional shift has likely reduced the urgency of a "randomly drawn" unemployed person obtaining a job; and thus a given unemployment rate in the 1970's may reflect a lower degree of excess supply in the labour market than the same unemployment rate in the 1950's or 1960's. Without wishing to label this phenomenon as a shift in the U-V curve or an increase in the natural rate of unemployment, the "pressure" from a given unemployment rate on wages may be quite different today than that of a decade ago.

To illustrate the changing nature of "measured" excess demand (supply) in the labour market, three different "proxy" variables are plotted in Chart I; (i) the national unemployment rate (U), (ii) the unemployment rate of prime aged males, 25-54 years (Upm), and (iii) the help wanted index, divided by the size of the labour force (V). Both unemployment rates, measures of excess supply in the labour market, have been graphed in reciprocal form (the traditional non-linear form of the Phillips curve) to facilitate direct comparisons to movements in the vacancy rate (a measure of excess labour demand). While the three proxies move in a coincident manner until approximately 1971-2, they diverge noticeably in the mid 1970's. Comparing the cyclical peaks in all three series reveals three different conclusions:

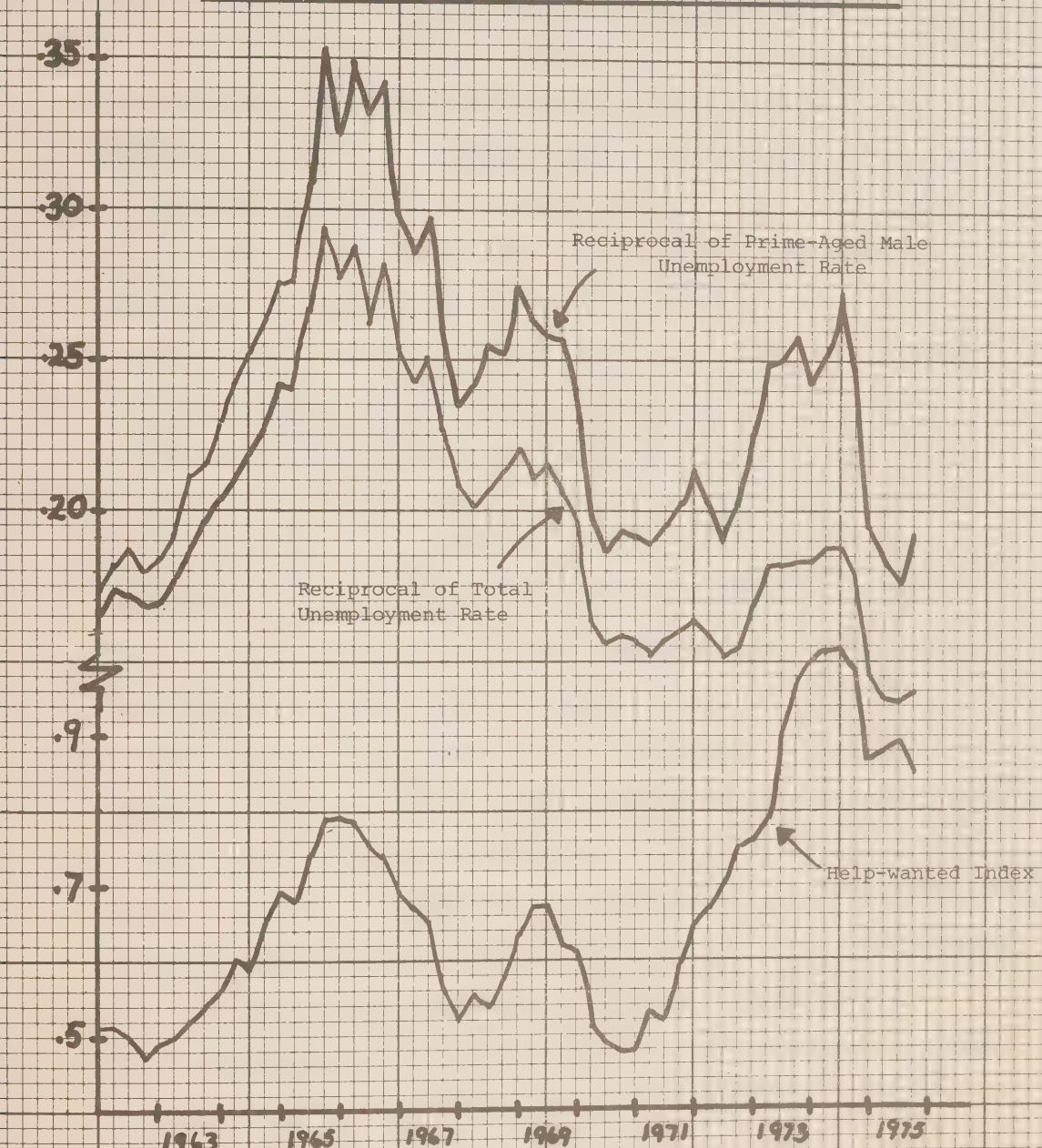
(i) V has a dominant peak in 1974;

(ii) Upm^{-1} has comparable peaks in 1969 and 1974;

(iii) U^{-1} has the lowest cyclical peak in 1974.

CHART I

THREE MEASURES OF CYCLICAL PRESSURE IN THE LABOUR MARKET



Given the substantial cyclical discrepancies in the relationship between U, Upm and V during the 1970's, one should expect marked differences in statistical performance for each of these labour market proxies in a wage determination equation.

The first three rows of Table 2 present "straight" Phillips curve estimates for the three labour market "pressure" variables, each of which is significant at the .05 level. However, the total unemployment rate has the "wrong sign", i.e., as unemployment rises, so do wages! Of the two labour market variables which have the correct sign, the help-wanted index strongly dominates the prime aged male unemployment rate in terms of goodness-of-fit. Since quantification of the responsiveness of wage inflation to movements in the cyclical excess labour demand variable is a key aspect of this study, the following "response coefficient" will be calculated throughout the study. Twice the average amplitude of the labour market cycle will be used to measure the typical movement in the labour market from a recession through to the peak of the next boom. For the help-wanted index, twice the average amplitude of a cycle is approximately .35 (see Chart I). Thus, equation (3) implies that an average labour market cycle (as proxied by V) will cause wages to rise by an additional 4.5% per annum[1] (12.31 multiplied by .35) as the economy moves from recession to peak (or a recession of average proportions should slow down wage inflation by about 4% per annum.) As we shall see below, equation (3) requires substantial structural modification which results in a greatly reduced wage inflation responsiveness to cyclical movements in excess labour demand/supply.

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[1] For equation (2), the response coefficient is in excess of 6% per annum.

TABLE 2

CONVENTIONAL PHILLIPS CURVE ESTIMATES
(t-statistics in parenthesis)

	Constant	I/U	1/Upm	V	$\dot{P}^e$	S.E.E.	$\bar{R}^2$
(1)	8.62 (14.77)	-7.47 (2.64)				3.847	.005
(2)	5.52 (9.79)		6.53 (2.87)			3.845	.006
(3)	-.76 (1.79)			12.31 (18.98)		3.380	.232
(4)	3.44 (7.26)	-1.51 (.70)			1.054 (29.84)	2.909	.431
(5)	3.25 (7.50)		-.55 (.32)		1.058 (29.79)	2.909	.431
(6)	5.12 (11.17)			-4.49 (4.63)	1.288 (21.10)	2.883	.441

All Phillips curve estimates known to this author include an additional variable to measure price movements. Following Phelps (1967) and Friedman (1968), this variable is usually interpreted as a proxy for future (expected) inflation. Workers are assumed to judge a prospective wage rate vis-a-vis the (expected) price level of goods which they purchase; labour market supply decisions are made in terms of "real" wage rates, and not "nominal" wage rates. Consequently, if workers expect inflation rates to rise, they will demand higher wage settlements, ceteris paribus, to compensate them for future higher rates of inflation.[1] Rising price expectations are assumed to push up current wage settlements.

To test the conventional price expectations ($\dot{P}^e$) model, the annual percentage change in the Canadian consumer price index (immediately prior to the signing of the contract) is employed as a proxy variable for price expectations at the time of the wage bargain.[2] The last three rows of Table 2 present estimates of the "price expectations Phillips curve" using the three labour market pressure variables. While the price expectations variable is an important determinant of wage settlements, the labour market variables change dramatically. All three labour market variables now have the "wrong" sign, with the help wanted index variable being "significantly" perverse. Furthermore, the coefficient on the expected price variable in equation (6) is significantly greater than unity (workers bargain for 129% of expected price changes and increase their demands as fewer vacant jobs exist!). Even though equations (4), (5) and

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[1] Failing an increase in nominal wages, workers are assumed to reduce the number of labour hours supplied at the new lower expected real wage rate.

[2] This is the conventional proxy, and has been employed by Bodkin et al., (1966) and Kaliski (1972) among others.

(6) offer better fits of the data, estimates for the implied structural parameters of the conventional price expectations Phillips curve do not accord with conventional economic wisdom. Thus, the micro data results of this study are comparable to the unsuccessful time-series estimates for a price expectations Phillips curve during the last decade.

III. A RE-ASSESSMENT OF THE CONVENTIONAL "PRICE-EXPECTATION" PHILLIPS CURVE

Given the deficiencies of the above price expectations Phillips curve estimates, one should perhaps reconsider the basic assumptions of the conventional price expectations model, particularly as it applies to collective bargaining. It is instructive to note that both of the original expositors of this "expectations" model, Phelps (1967) and Friedman (1968), lead into their analysis of labour markets with a discussion of financial markets (real versus nominal rates of interest). In fact, both economists base their "labour market theories" on the implicit assumption that labour and financial markets function in a similar manner.[1] For example, Phelps (1969) describes the new microeconomics of inflation and employment by the following analogy:

> "each morning .. workers 'shape-up' for an auction that determines the market clearing money wage and employment level (for the day)".

It is well to pause and consider some of the salient features of a financial "auction" market to determine whether analogies can be found in the labour market.

Most economists would agree that financial markets (such as stocks, bonds, treasury bills, foreign exchange, commodity, etc.) are competitive, atomistic, anonymous,[2] efficient markets. Such auction markets are well-

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[1] After discussing rates of interest in light of price expectations, Friedman states, "this analysis has its close counterpart in the employment market". (p.8)

[2] These markets are anonymous in the sense that buyers and sellers rarely meet (brokerage exists) and no lasting relationship exists between a particular buyer and seller. Each is simply searching for the best "bid" or "offer" with little likelihood that the same two parties will transact again. Even if the latter case did occur, the auction market functions as if it were <u>not</u> the case.

organized and the items traded are highly standardized. Given many "specialized" traders, the acts of uninformed or irrational buyers or sellers are quickly offset; and speculators and arbitragers are able to force rapid adjustment of prices to levels consistent with all relevant market information. Consequently, prevailing future expectations of price levels (among other items) are crucial to establish current demands and supplies.[1]

During the past decade, a highly sophisticated theory of wages-employment-output has evolved from the original Phelps-Friedman price expectations papers incorporating additional theoretical features such as information costs (search theory)[2] and "rational" expectations. Central to this theoretical development are two implicit assumptions: (i) the labour market is more or less analogous to a competitive, financial, auction market and (ii) price expectations are a crucial determinant of wages. In such models, workers supply labour on the basis of their expectations of future inflation. If prices are expected to rise by X%, wages will have to increase by X% to maintain the given supply of labour.[3]

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1 It is important to note that price expectations are explicit determinants of the demand and supply schedules, and <u>not</u> part of the <u>disequilibrium</u> process.

2 Briefly stated, job search theories relax the previous assumptions of homogenous (standardized) labour and the existence of an "organized" labour market. The unemployed person is assumed to follow an optimal search strategy as he/she searches through a constellation of heterogeneous job vacancies, comparing each offer to an optimal reservation wage. Unemployment is "voluntary" and arises because workers and firms have incomplete information concerning existing job vacancies and applicants.

3 In the parlance of such models, if wages were to rise by less than X% and workers supplied the same amount of labour, then workers would be suffering from "money illusion" (a fate worse than death in such theoretical models).

The application of the Phelps-Friedman expectational model to "micro" wage determination raises one interesting (but often overlooked) question. What happens to the "unexpected" gains/losses which are attributable to incorrect price expectations? It is important to note that no matter what process generates price expectations, be it rational or not, such expectations will typically be in error. Furthermore, learning to make better "expectational forecasts" on the basis of knowledge gained from one's "past" errors is not the same thing as "correcting" such past expectational errors. The Phelps-Friedman model provides no direct mechanism for the individual firm (or union) to rectify inappropriate past price expectations by simply adjusting the wage rate. In a Phelps-Friedman world, an indirect feedback mechanism corrects for past expectational errors via changes in aggregate output and employment. Past errors in price expectations will cause the unemployment rate to deviate from its natural rate which sets in motion a "Phillips curve" effect which will "correct" nominal wages for past expectational errors. Workers are assumed to bargain vigorously for "full" price expectations,[1] but are content to let the market process (eventually) correct for any expectational errors.[2] Each transactor in the wage contract implicitly bears the risks of incorrect ex ante price expectations (i.e. that the "market" will ex post sort out past expectational errors). Such "assumed" economic behaviour is, of course, found in financial markets where each transactor bears the risk of incorrect expectations without recourse to the other party. No rela-

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[1] In a wage-change equation, the coefficient on the expected price variable is assumed to be unity.

[2] Several recent studies have explicitly included a variable to reflect past expectational errors (catch-up), although the form of such variables is quite different from that used in this study. See, for example, Turnovsky (1972), Johnston and Timbrell (1973), and de Menil and Bhalla (1975).

tionship exists between the two parties, save this one (financial) transaction; and in such a competitive, anonymous auction (financial) market there is no reason for the "unexpected" winner to share his (short-run) gains with the loser. More to the point, it is this latter feature (a potential for gain by outguessing market expectations) which is the raison d'être of much financial transacting.

In the labour market, the institutional arrangements and raison d'être are quite different. Anonymity and "one shot" transacting are replaced by a long-run relationship between the two parties (the firm and labour).[1] Both "sides" regularly enter into legal contracts with each other, principally to establish prices (wages) and not quantities. Between contract negotiations, the two parties typically have substantial contact with each other and are involved in numerous mutual concerns. In such a continuing relationship between two parties, "unexpected" gains/losses attributable to incorrect (price) expectations cannot be ignored or assumed away.[2] By-gones are clearly not by-gones, but rather are important issues at the next contract negotiations.

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1 Theoretical reasons for a "long-run" relationship between labour and the firm are discussed in the next section.

2 To illustrate this point, a three year contract signed in 1972 might be reasonably based on annual price expectations of 4 to 5%, resulting in unexpected loss to workers of approx. 15%. It would be naive to assume that the next contract negotiated in 1975 would proceed as if this "loss" did not occur, i.e. the loser bears the entire loss. While in the long-run, "errors" in price expectations may cancel out or work themselves out; in the short-run, the "losing party" may not be content with assurances that in the long-run he will "break even" or that the "market" will eventually restore the real wage via adjustments in unemployment rates which feedback into wages.

Thus, an essential (but rarely explored) feature of "price expectation theory" applied to micro wage determination is an explicit "error correction" process for unexpected gains/losses arising from incorrect price expectations. Our basic hypothesis is that the wage determination process consists of two distinct "price" elements:

(i) a provision for future expected inflation

(ii) a provision for "uncompensated" (or "overcompensated") past inflation.

This latter element can arise in two ways. First, the wage contract may not include 100% coverage for future expected inflation. Second, forecasts of future inflation likely will be wrong and consequently an inappropriate provision for future inflation may have included in the past wage settlement (even if the coefficient on expected prices were unity). It is a central argument of this paper that labour will bargain just as vigorously for uncompensated past inflation ("catch-up") as it does for future price expectations; and that it is in the firm's long-run interest to regard such catch-up as a reasonable demand of labour (to preserve the long-run relationship between labour and the firm). In the parlance of a Phelps-Friedman model, the absence of money illusion should only arise when full recontracting has occurred.

Furthermore, if it is well understood by both sides of a wage contract that "uncompensated" past price inflation will be included as a bargaining issue in the next wage negotiations, there is no reason to expect that 100% of future expected inflation will be included in wages ex ante. Given the uncertainty of future price expectations over a two to three year horizon (the usual contract length) and the opportunity to correct past expecta-

tional errors ex post, the wage determination process may assign a relatively low weight to future (uncertain) expectations. In such circumstances, future price expectations may be a relatively inconsequential factor in the wage settlements and should not be the "cornerstone" of an elaborate theoretical superstructure to describe wage-employment-output determination and macro-economic policy. Furthermore, rationalizations of an "incomes policy" as a means to "dampen price expectations" may largely be beside the point. Current wage settlements may be primarily based on past inflation rates and past expectations (recovering ex post uncompensated past inflation) and be relatively immune from future ex ante price expectations.

To analyze a Phillips curve model which includes both price components, the following price specification is proposed:

$$a\dot{P}^{e}_{t} + b([\dot{P}^{ACT}_{t-1} - a\dot{P}^{e}_{t-1} * \ell_{t-1}]\frac{W_{t-1}}{\ell_t W_t})$$

where $\dot{P}^{e}_{t}$: annual expected inflation at the time of current contract

$\dot{P}^{e}_{t-1}$: annual expected inflation at the time of previous contract

$\dot{P}^{ACT}_{t-1}$: actual inflation rate over the previous contract

ℓ_{t-1} : length of previous contract (in years)

W_{t-1} : base wage rate at time of previous contract negotiations

For expositional purposes, the large expression following "b" will be referred to as price "catch-up" $(\dot{P}^{cu})$.[1] If "a" is zero (i.e. there is no provision for future inflation), then $\dot{P}^{cu}$ will simply be the actual rate of inflation over the previous contract multiplied by the previous wage

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[1] While the exposition assumes that labour is "catching-up", the concept is symmetrical in the sense that firms will catch up if expected inflation exceeds actual inflation rates.

rate (this measures the "short-fall" in real wages) divided by $\ell_t W_t$ to convert this short-fall to an annual percentage. The value of ℓ_t is crucial as this factor determines the length of time over which this real short-fall can be apportioned. A positive value for the parameter "a" would reduce the potential size of $\dot{P}^{cu}$, although even if "a" were unity, $\dot{P}^{cu}$ would still exist if past price expectations were incorrect.

Table 3 provides estimates of this expectational error correction model for each of the three labour market variables. The first three rows assume no price expectations (i.e. a = 0) while the last three rows provide estimates of both "a" and "b", the complete price expectations - catch-up model. It is instructive to compare these estimates to those contained in Table 2 (the conventional price expectations Phillips curve). First, in all cases the error-correction model provides a better fit of the data than the conventional estimates of Table 2. Furthermore, both price elements ($\dot{P}^{e}$ and $\dot{P}^{cu}$) are significant, with a much greater weight on error correction than future expected inflation. In terms of the labour market variables, three quite different results are evident. The total unemployment rate continues to exhibit an "incorrect" (but insignificant) sign, while the prime-aged male unemployment rate is correctly signed in both cases, but only significant in equation (8). The vacancy rate equation has a slightly superior "fit" and the labour market variable is significantly greater than zero in both cases. By all statistical criteria, equation (12) is the preferred wage-equation.

The properties of equation (12) are quite striking. Even though the vacancy rate is significant, its effect on wage settlements is very modest. The response coefficient, as defined to above, is only .6% per

TABLE 3

PRICE EXPECTATIONS-CATCHUP PHILLIPS CURVE ESTIMATES

	CONSTANT	1/U	$1/U_{pm}$	V	$\dot{P}^e$	$\dot{P}^{cu}$	SEE	$\bar{R}^2$
(7)	3.92 (8.64)	-3.8 (.18)				1.016 (31.73)	2.831	.461
(8)	2.75 (6.50)		4.53 (2.71)			1.013 (31.90)	2.822	.464
(9)	1.81 (4.91)			3.81 (5.90)		.892 (23.58)	2.790	.476
(10)	4.16 (9.81)	-2.06 (1.00)			.289 (7.44)	.900 (25.00)	2.782	.480
(11)	3.27 (7.98)		1.98 (1.16)		.269 (6.74)	.910 (25.55)	2.782	.480
(12)	2.79 (5.89)			1.81 (2.12)	.197 (3.19)	.881 (20.88)	2.778	.481

annum. In other words, an average economy upswing (from recession to peak) adds only an additional .6% per annum to wage settlements.[1] This sluggish response of wage changes to labour market conditions (for reasons discussed below) implies a very flat Phillips curve. Secondly, "average" conditions in the labour market (i.e. a mean value of V) and no price inflation imply an annual wage change of 3.95%, a value which is virtually identical to the annual growth rate of real output per manhour in the manufacturing industry over the 1962-75 period. Finally, the price effects are substantially different from conventional price-expectations Phillips curve estimates. Only 20% of future expected prices is included ex ante. On the other hand, 88% of uncompensated inflation is recovered ex post.[2] If the rate of inflation were constant (and fully expected), slightly in excess of 90% of price changes would be incorporated into wage rates. While this estimate does imply a modest degree of money illusion, one should recall that labour is receiving about 4% per annum (on average) over the inflation component, and is clearly enjoying gains in real wages.[3]

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1 During the entire period, the average annual wage settlement exceeded 7%, suggesting that the cyclical movement in the labour market accounts for under 10% of the movement in wages.

2 This coefficient on the price catch-up variable is significantly <u>less than unity</u> in equation (12) as is the case in equation (10) and (11).

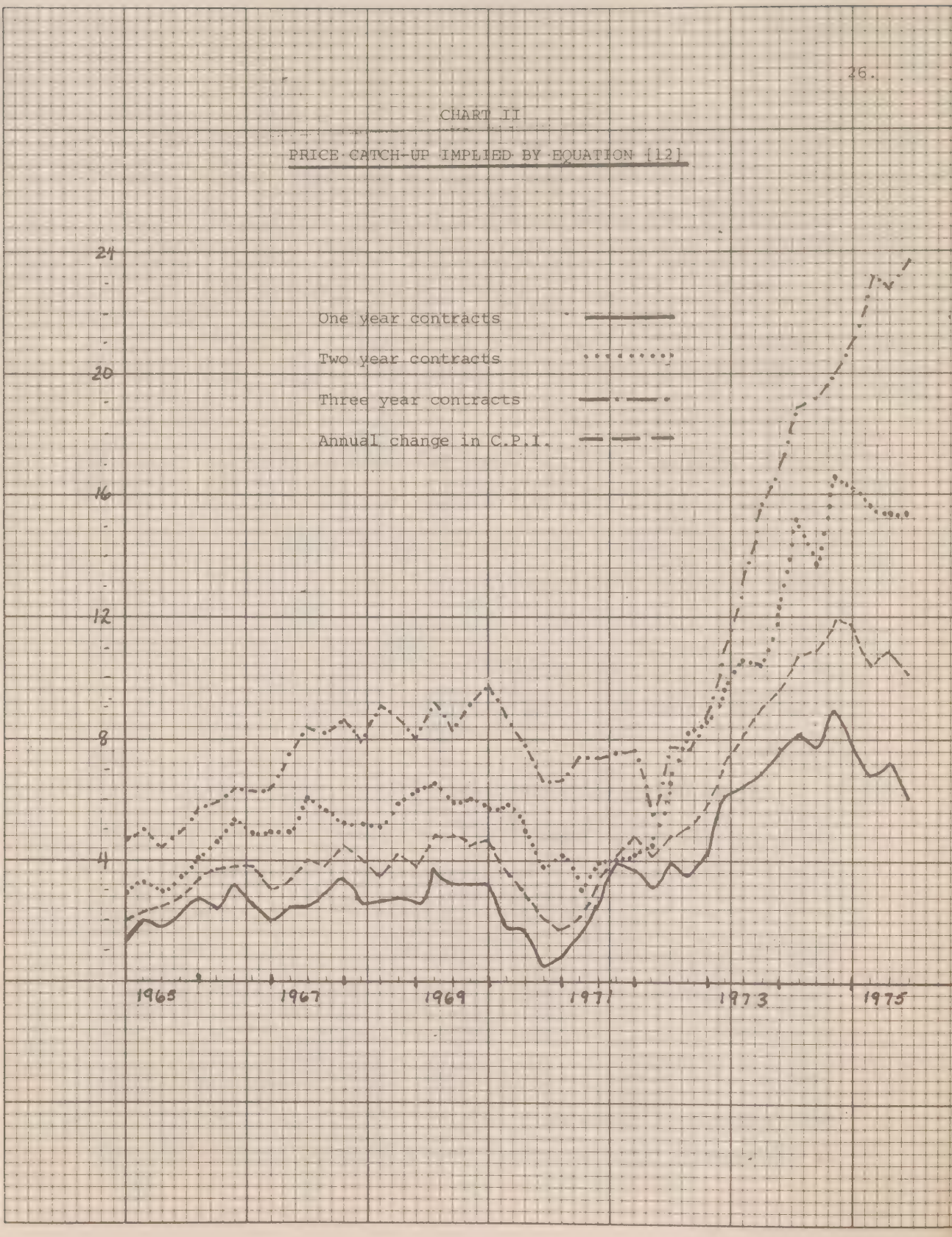
3 While there has been a great deal of debate in the literature about "money illusion", one could also make a case for "productivity illusion" (i.e. the failure to be paid one's full marginal product). In addition, one might feel systematically "cheated" by a cyclical labour market in the sense that one's own multi-year contract always seems to be negotiated when the labour market is "slack" (the financial market equivalent would be the unhappy circumstance of having to renew a five-year mortgage when the mortgage rate is at 12%). There are many ways of being cheated or fooled, not the least of which is the taxman, and one should be careful about singling out one particular factor while ignoring many other dimensions in a perhaps "unjust" world.

To illustrate the relative importance of the underlying determinants of wages, two additional Charts are presented. First, in Chart II data reflecting the amount of catch-up implied by equation (12) for one, two and three year contracts, along with the annual change in consumer prices, are plotted. For example, a three-year contract expiring in the first quarter of 1975 would require an additional 21.1% (spread out over the life of the next contract) to restore its real wage. For one and two-year contracts expiring in the first quarter of 1975, the additional catch-up requirements are 7.8% and 16.3%. Clearly, the largely "unexpected" high inflation rates of the 1973-74 time period generated a substantial amount of price catch-up which had to be worked through the bargaining process during the 1974-1976 wage rounds. Such price catch-up cannot be "proxied" by the simple annual inflation rate as the relationship between price catch-up and actual movements in the CPI is highly non-linear, dynamic and depends on the lengths of successive contracts (which is variable).

Chart III decomposes the "predicted" wage change (from equation (12)) for a two-year contract sequence into its four underlying components. The initial rectangular layer represents the size of wage settlements for zero price inflation (both $\dot{P}^{e}$ and $\dot{P}^{cu}$) and average conditions of excess demand/supply in the labour-market. As pointed out above, this rectangle is virtually identical to the annual rate of growth of real output per manhour in the manufacturing sector over the 1962-75 period. The next layer represents that portion of the wage settlement designed to protect workers against future inflation. Given the low coefficient on $\dot{P}^{e}$ in equation (12), ex ante expected inflation protection is a very small portion of any wage

CHART II

PRICE CATCH-UP IMPLIED BY EQUATION (12)



settlement. The third area (between the two solid lines) represents the amount of price catch-up which is included in a two-year contract sequence (see Chart II). As is evident from Chart III, price catch-up is the dominant component of wage settlements from 1972 on, and is always quantitatively more important than the price expectations component. Finally, the dotted line incorporates the cyclical effects of excess demand/supply in the labour market along with the other three components, i.e. the dotted line "simulates" wage settlements for each quarter, assuming two-year contracts and the parameter estimates of equation (12). Consequently, the area between the two highest lines represents the wage consequences of a tight or slack labour market (the Phillips curve effect). As is obvious, the effect on wage settlements of cyclical variations in excess labour demand/supply appears to be relatively small.

To derive a "conventional" Phillips curve for equation (12), it is first necessary to translate the help wanted index (V) into a "comparable" level of unemployment (U). One convenient way to describe the relationship between V and U is to examine the statistical features of a scatter diagram between these two labour market variables. Economists have frequently fitted a (rectangular hyperbola) curve to this scatter diagram, known as the "UV curve".[1] Movements along this UV curve measure "changing" cyclical excess demand/supply for labour (i.e. a higher V or a lower U), whereas a shift in the UV curve would reflect a change in frictional or structural levels of unemployment (and not necessarily a change in cyclical labour market pressure). Labour market induced wage effects would principally be associated with movements along

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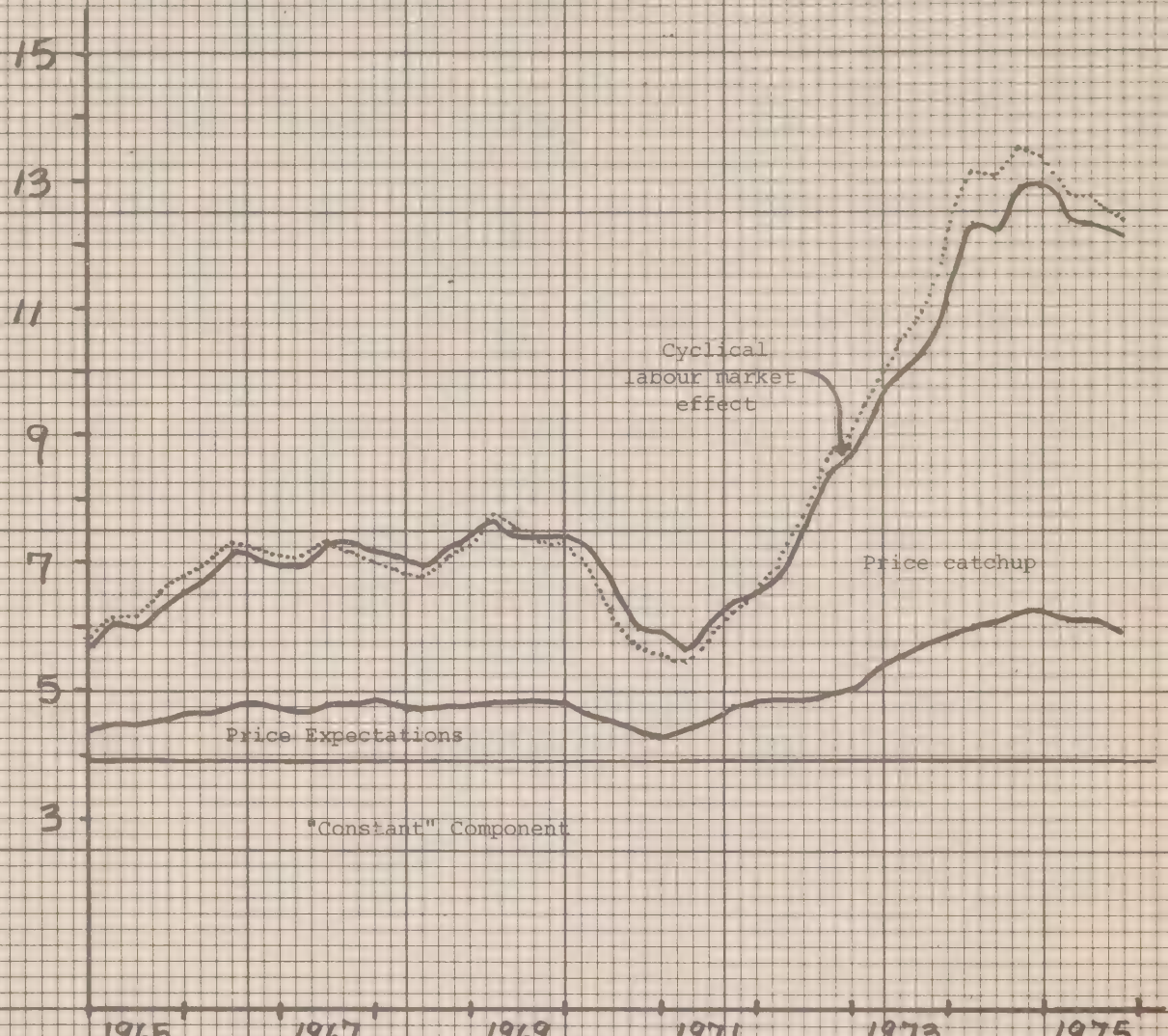
[1] For a discussion of the UV curve, see Cousineau and Green, Chapter 4.

CHART III

DECOMPOSITION OF WAGE SETTLEMENTS INTO FOUR COMPONENTS
(for two-year wage contracts)



the UV curve and not necessarily associated with shifts of the UV curve (which may result in the same degree of excess demand pressure within the new structural labour market). If there is no shift in the UV curve, then one can utilize either U^{-1} or V data in the Phillips curve since V is equal to a constant multiplied by U^{-1}. If the UV curve has shifted, the relationship between U and V will be altered as a new constant will prevail. In this latter case, U^{-1} and V data are not substitutable in a wage equation, and different statistical results would arise when U^{-1} is replaced by V (as is evident in Tables 2 and 3).

To examine the stability of the UV curve, the product of U and V (the "constant") is plotted in the upper panel of Chart IV. It is readily apparent the U*V is roughly constant in the 1962-70 period, but that this stability breaks down in the 1971-3 period. This instability corresponds to the changing cyclical properties of U and V discussed in Section II (see Chart I) and will be reflected in an outward shift of the UV curve itself. In the lower panel of Chart IV a scatter diagram for U and V, divided into three time periods, is presented. The first (1962-70) and third (1974-76) time periods are assumed to be roughly stable (with "given constants"[1]) whereas the middle time period (1971-3) represents a transitional (unstable) period. No attempt is made to explain why the UV curve shifted out in 1971[2], but rather we simply accept the empirical fact

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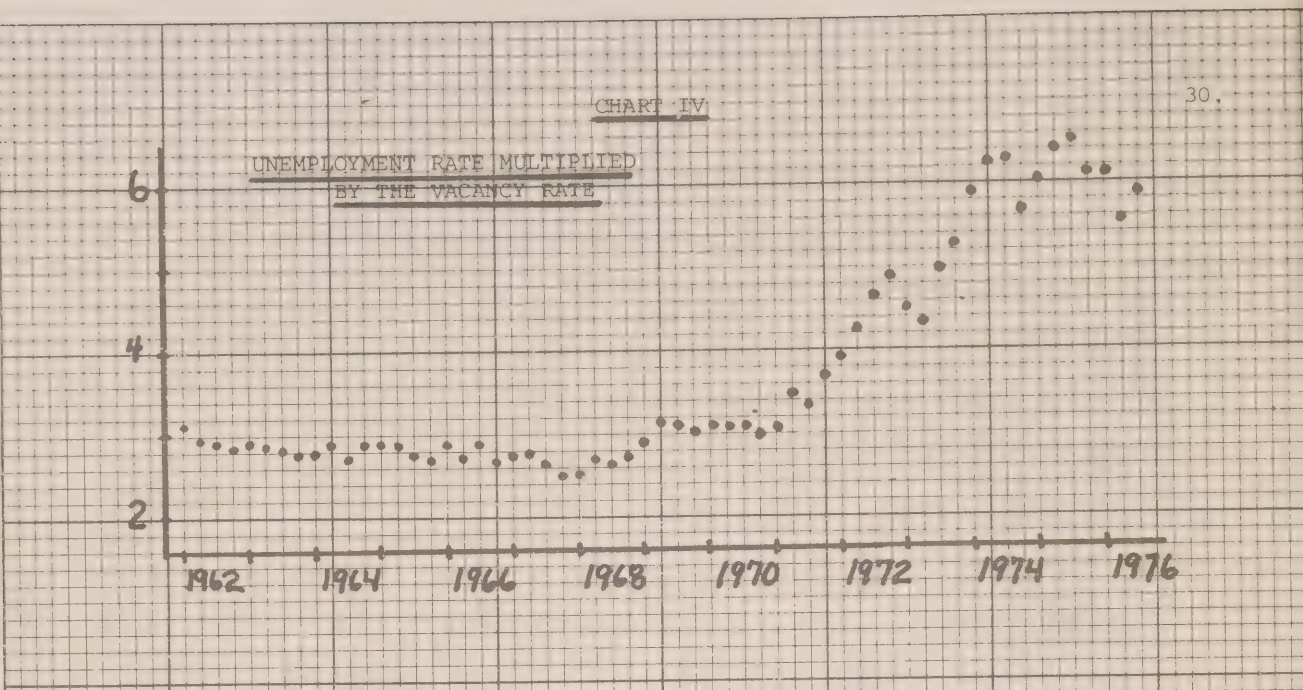
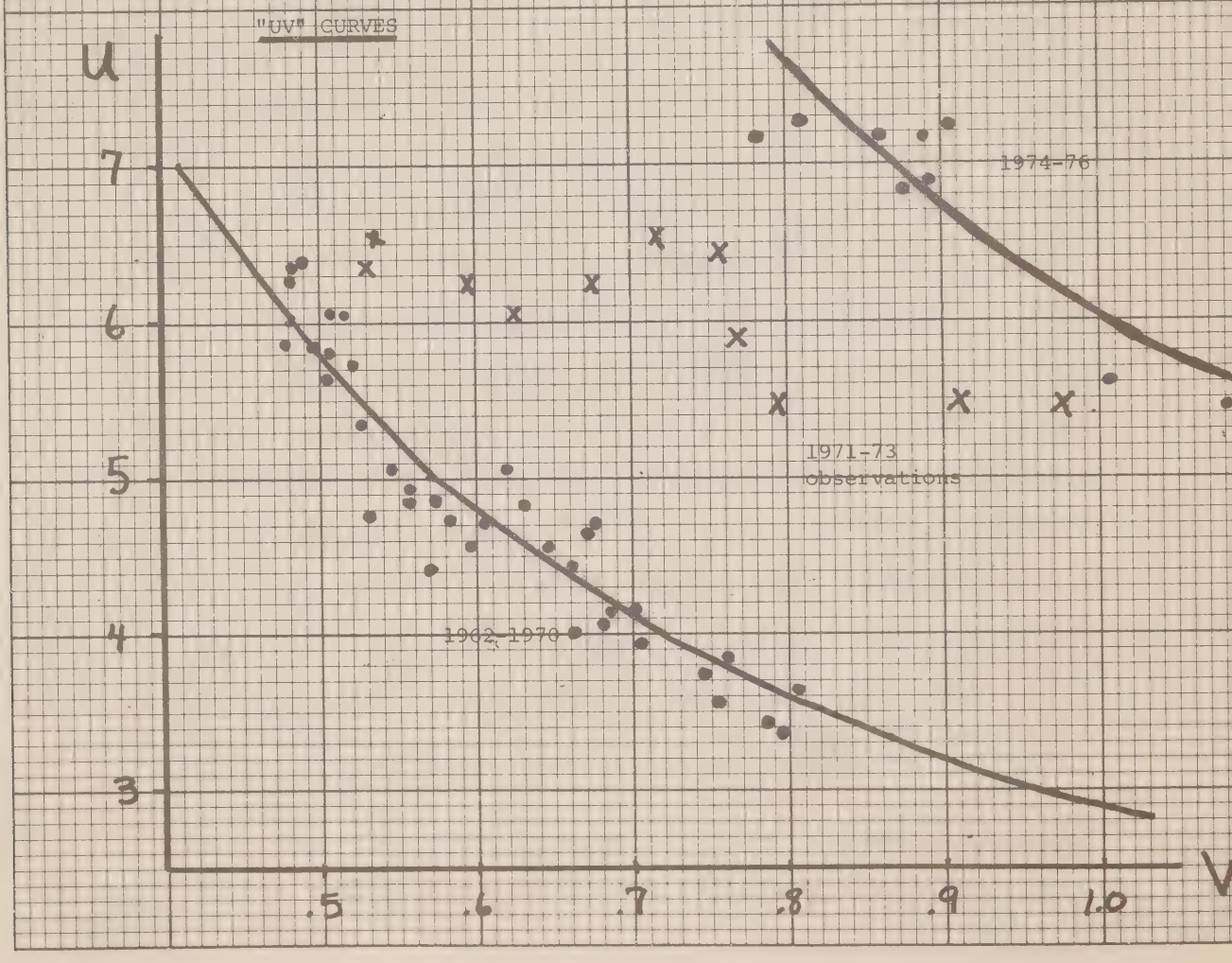
1 The average value of UxV is 2.87 during 1962-70 and 6.06 during 1974-76. These two values are employed as the constants in the UV curves which are explicitly drawn in Chart IV. It should also be pointed out that the 1974-76 period is not nearly as stable as that found in the 1962-70 period.

2 Again, the reader is referred to Cousineau and Green, as well as the brief discussion in Section II of this paper (i.e. the changing composition of the unemployed pool).

CHART IV


UNEMPLOYMENT RATE MULTIPLIED BY THE VACANCY RATE
6
4
2
1962
1964
1966
1968
1970
1972
1974
1976


"UV" CURVES
U
7
6
5
4
3
1974-76
1971-73
observations
1962-1970
.5
.6
.7
.8
.9
1.0
V

that it did shift and examine the implications for the Phillips curve.

As demonstrated in Chart V, the wage-vacancy rate relationship (equation (12)) can be mapped into a "traditional" wage-unemployment rate (Phillips curve) relationship.[1] The outward shift in the UV curve in 1971-3 implies a similar outward shift in the Canadian Phillips curve. In other words, the changing nature of the Canadian labour market in the 1970's has produced a substantial deterioration in the wage-inflation-unemployment trade-off facing Canada. Approximately one extra percentage point of wage inflation is now associated with a given unemployment rate in the 5 to 7% range (attributable to the shift in the UV curve during the early 1970's).

In addition to this recent deterioration in the Canadian Phillips curve, the (short-run) Phillips curve is quite flat in the relevant unemployment range. For the 1974-76 version of the UV-Phillips curve, an increase in the unemployment rate from 4% to 7% generates only a one percentage point reduction in the rate of wage change (i.e. from 10% to 9% assuming a fully anticipated 5% price inflation rate). Thus, even though a "significant" Phillips curve exists, only a slight short-run moderation in wage settlements can be achieved from adverse conditions in the labour market. Consequently, government demand management policies which induce (or tolerate) higher rates of unemployment to "fight inflation" will have only modest short-run effects on reducing the inflation rate.

However, as restrictive demand management policies take hold,

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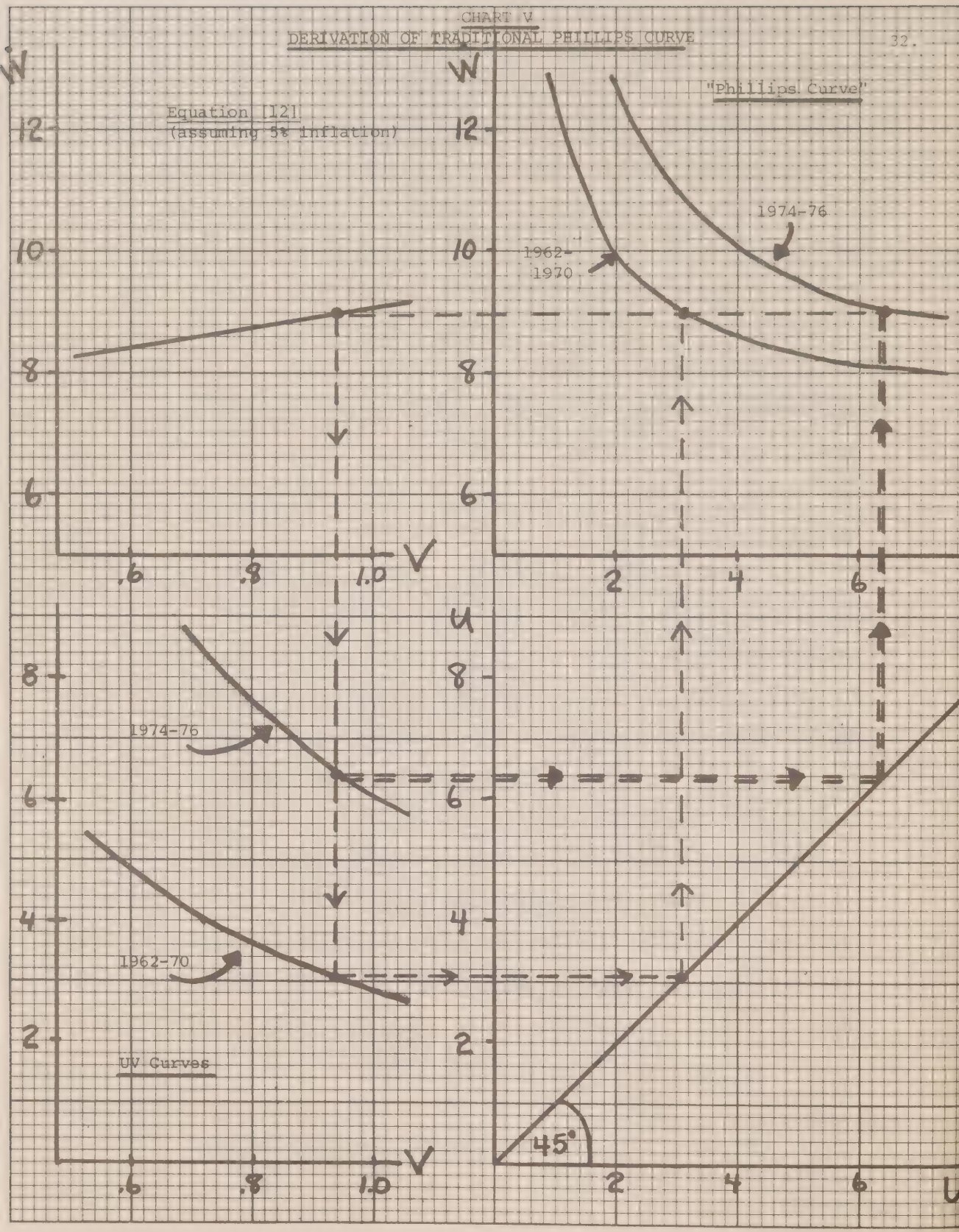
[1] Taking the upper left panel as a starting point, move counter-clockwise through the lower panels to the upper right panel ("the Phillips curve").

CHART V

DERIVATION OF TRADITIONAL PHILLIPS CURVE



these "slight" or "modest" reductions in the rate of wage inflation will be followed by a deceleration in consumer price inflation. This latter consumer price deceleration will feedback into the next wage settlement causing a further decline in wage inflation (the short-run Phillips curve will shift down) which will induce a further decline in consumer price inflation, etc., etc., etc.[1] The longrun Phillips curve describes the relationship between unemployment and wage changes after all the price feedback effects have taken place (or put in other words, after the rate of price inflation is constant again, not accelerating or decelerating). As a number of economists have shown,[2] the slope of this longrun Phillips curve will depend critically upon the coefficient(s) of the price variable(s) in the wage equation. If the composite price coefficient in the wage equation is positive but less than unity, then the longrun Phillips curve will be "steeper" than the shortrun Phillips curve. On the other hand, if the composite price coefficient is not significantly different from unity, then the longrun Phillips curve will be perfectly vertical. In this latter case, there will be no longrun trade-off between wage changes and unemployment, and there will be one unique value of unemployment (the "natural" rate) for which the rate of price inflation will be constant.[3]

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1 In terms of the earlier discussion of the "shortrun" Phillips curve, one cannot maintain a constant value (e.g. 5%) for price inflation as the wage change declines in response to restrictive demand management policies (i.e. 5% price inflation will give way to 4% price inflation which will give way to 3% price inflation, etc.).

2 See, for example, Rothschild (1971).

3 For a more complete discussion of the natural rate of unemployment, see Phelps (1967), Friedman (1968) or Rothschild (1971).

As shown in Table 3, the estimated price coefficients for Canadian manufacturing wage change equations are dangerously close to unity. The composite price coefficient for a fully anticipated movement in the consumer price index is .904 in equation (12). Thus, the empirical evidence suggests that the longrun Phillips curve may be very steep, perhaps even vertical. Consequently, the policy maker may be confronted with the worst of both worlds: very little shortrun leverage on wage inflation via demand management policies and a virtually vertical longrun Phillips curve at an intolerably high "natural rate" of unemployment. As will become evident in the next section, this statistically significant short-run Phillips curve provides even less policy leverage when wage spillovers are included in the model.

IV. WAGE SPILLOVERS

One of the oldest themes in the analysis of wage rates is the importance of wage spillovers. Most of these spillover theories originated in the "institutional school" during the 1940's and early 1950's,[1] and emphasized the importance of social/political forces almost to the exclusion of economic/market forces. While "modern day economists" have tended to dismiss wage spillover theories (given their institutional origins), the concept of a wage spillover is also in the tradition of micro economic analysis of labour markets. For purposes of this paper, wage spillovers will be defined in the "econometric sense" as a direct causal relationship between a previous wage settlement(s), the explanatory variable, and a given wage settlement, the dependent variable. In other words, previous wage settlements "cause" or "spillover into" current wage settlements.

Before adopting a wage spillover model, two major theoretical issues must be resolved. First, what is the transmission process behind such wage spillovers, or what theoretical justification can be given for the causal process? Second, are there additional determinants of wages or do "only spillovers matter"? It is the contention of this paper that at the "micro" level, (i) there are theoretical explanations for a wage transmission process, (ii) such theoretical explanations are based on economic principles, and (iii) this theoretical wage transmission process does not operate independently of other economic determinants of

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[1] Institutionalist spillover/relativity theories can, of course, be traced back in political economy thought to much earlier writings (Thorstein Veblen in particular).

wages. In other words, the model presented in Section III must be enlarged (not scrapped) to include wage spillovers.

Lurking behind these "theoretical issues" are two nasty "empirical" problems. First, how do we identify which previous settlements are "causing" a given wage settlement? Secondly, can we statistically separate "causation" from "correlation"? For example, two successive settlements could be "determined" by the same set of economic factors and thus have virtually identical values. The second settlement obviously will "correlate" highly with the first, but will not be "caused" by the first. Both settlements are "caused" by a set of common economic explanatory variables. Given the ease of mistaking correlation for causation, it is all the more imperative to provide clear cut answers to these two major theoretical issues.

A theoretical justification for micro wage spillovers is implicit in a Marshallian partial equilibrium analysis of labour markets. For any given firm, the (equilibrium) wage rate that the firm will pay depends on the firm's demand for labour and the supply of labour to that particular firm. For the sake of argument, assume that labour is homogenous but that firms have different characteristics. Some firms are located closer to residential areas (therefore have lower commuting costs), some firms have less attractive working conditions (blast furnaces), some firms offer better prospect for advancement, etc. In short, there are a number of costs and benefits attached to employment with a given firm in addition to the wage rate paid by that firm. The supply of labour to this firm will be a function of all of these factors (including the wage rate paid by the firm) as well as the wage rate and

working conditions which exist at alternative (substitute) firms.[1] If an alternative firm were to increase its wage rate to attract more labour, then the supply of labour to the previously given firm would decline as a number of "marginal" workers would now evaluate the alternative firm more highly and switch employers. Thus, the (equilibrium) wage paid by the initial firm will increase given the reduced supply of labour to that firm. Clearly, the "reduced form" determination of wages for a given firm is a function of all the usual demand and supply factors, the latter which includes the wage rates paid by competing (substitute) firms. A change in wage rates paid by another firm will "spill into" the given firm's wage rate with the size of the spillover determined by the relevant cross price elasticity of the supply curve and the slope of the demand curve.[2]

About a decade ago, Phelps (1967) proposed a generalized excess-demand model for "frictional labour markets that allocates heterogeneous jobs and workers without having perfect information and market clearance by auction" (p. 706). This model is in the spirit of the previous Marshallian analysis with the key innovative feature being the (labour) cost to the firm of its "turnover rate". Such costs are based on fixed expenditures in recruitment, hiring and training new workers to replace those who quit.[3] The profit-maximising firm will establish an optimal wage differential between its own wage rate and the wage rate

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1 In such a world, the wage rates paid by different firms would not be the same (even though labour is homogeneous).

2 For an empirical application of a similar model, see McGuire and Rapping (1968).

3 For an earlier discussion of the "quasi-fixed" costs of labour, see see Oi (1962).

paid by other firms, a differential which minimizes the firm's total labour costs.[1] Thus, if other firms raise their wage rate, the given firm must change its wage rate to maintain the optimal wage differential. The wages paid by one firm spill into other firms.

In both the Marshallian and Phelps models, one might argue that changes in the excess labour demand/supply variable will capture the effect of another firm altering its wage rate, i.e. one need not include the spillover effect directly as its effect is implicitly buried in the labour market variable. This may, in fact, be the case if a precise measure of excess labour demand could be obtained for each micro labour market. However, the logic of this argument would require that all explanatory variables be suppressed in the Phillips curve with the exception of a measurement for excess labour demand/supply since this one unique value captures all relevant demand and supply information. For example, price expectations, which are determinants of both the demand and supply curve of labour, would no longer be included as a separate economic factor since the excess demand/supply of labour variable will also contain this effect as well. Most wage change studies have proceeded with an inelegant hybrid equilibrium-disequilibrium model in which various determinants of labour demand and supply directly enter into the wage change specification along with a measure of disequilibrium.[2]

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1 Labour costs consist of "variable" wage payments and "fixed" hiring/training costs. The firm could, of course, pay sufficiently high wages to reduce quit rates to zero; but presumably a slightly lower wage rate coupled with some quits (i.e. turnover costs) would lower total labour costs.

2 See, for example, Tobin (1972) and Reuber (1970).

Furthermore, as pointed out above, our proxy measures for excess labour demand/supply are very rough and exist only at an aggregate level. Thus, the national unemployment or vacancy rate may be a very poor indicator of excess demand/supply in a particular micro labour market, not to mention its failure to capture changes in long-run equilibrium determinants of wages (such as the inflation rate).

During the last several years, a number of economists have begun to re-analyze the labour market in terms of economic models which "explain" the longrun relationship ("implicit contracts") between labour and the firm.[1] Such models are in direct contrast to the anonymous, auction market models discussed in Section III of this paper, and have important implications for the specification of micro wage equations. A brief review of the economic rationale for establishing a long-run relationship between labour and the firm is presented, followed by a discussion of the implications of such an approach for the specification of price, labour market, and spillover variables in a micro wage equation.

Building on the earlier work of Oi and Phelps Okun describes the firm's economic motives for establishing a long-run relationship with labour.

> "Many employers adopt policies to promote long-run attachment by workers. They pursue that strategy because the value of an experienced worker exceeds that of an inexperienced one by a margin greater than the corresponding wage differential. Entering workers impose costs on the firm of screening, hiring, training, and on-the-job learning; yet they cannot be made to bear these costs

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[1] See, for example, Okun (1975), Gordon (1974) and Tobin (1972).

> fully through a lowered entering wage. For one thing, many of these "investments" are valuable to the worker only insofar as he remains an employee of that firm; the nontenured recruit will not pay for them .... Thus, the firm really makes an investment in a new worker, spending more to hire, train, and pay him than he is worth in the short run. But it must then amortize that investment by paying wages below marginal revenue product to workers who become experienced. Nonetheless, the firm wants to maintain wage rates for experienced workers above those of their next-best opportunity in the labor market in order to hold down quit rates and protect its investment. .... (the) wage must exceed his perceived alternative and be less than his current marginal revenue product."
>
> Okun (1975), pages 366-7

From labour's point of view there are equally as compelling economic reasons for entering into a long-run relationship with a given firm. While it has become fashionable to regard the payment to labour as a "return to human capital", fundamental differences exist between human capital and physical or financial capital. Even though both forms of capital are subject to risk, the owners of human capital cannot reduce this risk as readily as the owners of non-human capital. For example, one cannot typically enter into future, contingent, or mortgage contracts with respect to human capital. Furthermore, it is very difficult to diversify human capital. To paraphrase D. F. Gordon (1974), 'one cannot sell a piece of oneself as a carpenter in Vancouver to purchase a portion of a civil servant in Ottawa'. Given risk aversion on the part of individual (particularly when most of one's wealth is held in "human capital"), and the inherent problems of reducing the risks of human capital, there is mutual gain available to both employers and employees by entering into long-term relationships (implicit quasi-

contracts" in the terminology of Gordon [1974]).

In less technical terms, Tobin (1972) described this long-run relationship (an "implicit" contract) between labour and the firm in the following manner:

> "The employer makes some explicit or implicit commitments in putting a worker on the payroll in the first place. The employee expects that his wages and terms of employment will steadily improve, certainly never retrogress. He expects that the employer will pay him the rate prevailing for persons of comparable skill, occupation, experience, and seniority. He expects such commitments in return for his own investments in the job; arrangements for residence, transportation, and personal life involve set-up costs which will be wasted if the job turns sour. The market for labor services is not like a market for fresh produce where the entire current supply is auctioned daily. It is more like a rental housing market, in which most existing tenancies are the continuations of long-term relationships governed by contracts or less formal understandings."
>
> (1972, p. 12)

There are a number of implications of a long-term relationship between labour and the firm for the specification and interpretation of a micro wage equation. First, the role of the "market" (the Phillips curve effect) will likely be muted. The labour market still exists, but wage rates will be less sensitive to excess demand/supply forces than would be the case in a competitive, anonymous, auction market. Firms will principally "compete" for relatively inexperienced workers who typically enter the firm near the bottom of the wage scale. As the "new" worker gains experience with the particular firm, he/she will progress up the wage scale and become more (and more) sheltered from the rigors of the market process. Since such experienced workers earn more

than their opportunity wage, a "tight" labour market will have only a modest impact on the quit rate of experienced workers. If the normal queue of applicants for the "ports of entry" jobs is insufficient, the firm must raise the base wage rate to attract new workers. However, the firm is likely to resist large base rate adjustments in response to cyclical tightness in the labour market as all "internal" wage rates (the scale) would have to be adjusted to preserve equity with the existing work force (the maintenance of long-run relationships with "experienced" workers.) This explanation does not deny the existence of a competitive labour market, but does suggest that it is limited to a small fraction of the work force. Given that any wage rate change for this small part of the work force will permeate throughout the entire work force, the response of wages to cyclical changes in excess labour demand is likely to be much less pronounced than would be the case in a complete auction market setting (where the "new" price is established for only the "traded" commodities).

In addition, the presence of multi-year contracts may further mute the effects of cyclical excess labour demand variables. Once a contract is legally established, it is difficult to renegotiate the wage scale. Thus, if a firm enters into a three year contract when the labour market is very tight, the firm must live with the implied higher wage scale for the next three years, a period of time when labour conditions may change dramatically (see Chart I). Thus, the firm may attempt to smooth out (discount) some of the natural cyclical movement in the labour market and settle in terms of a wage scale which will be appro-

priate (in terms of attracting inexperienced workers) for the duration of the contract.[1] Again, the labour market exists, but likely responds in a very sluggish manner to movements in excess labour demands or supplies.

Secondly, the existence of a long-term relationship is not meant to imply "total harmony" between labour and the firm. Okun has described the wage determination process in the following manner:

> "The big issue in wage setting is a long-run battle over the division of the bilateral monopoly surplus between employers and experienced workers. Each side perceives the short-run elasticity of the other as relatively low, but the long-run elasticity as substantial. Hence, workers do not want to squeeze the firm into graduate extinction; and the firm does not want to press the workers to the point of explosive quit rates. These boundaries, however, may contain a wide area of sharp conflict of interest; and standards of fairness are sought to preserve the surplus available to the two sides combined."
>
> p. 369

In other words, firms and labour (unions) attempt to divide the (long-run) "bilateral monopoly surplus" in an "equitable" manner through the collective bargaining process. Firms and labour may, of course, adopt different standards of "fairness" and vigorous bargaining (including the threat, and possible occurance, of strikes and lockouts) will likely be required to resolve these differences.[2]

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1 This argument assumes that the "length" of the contract is relatively fixed, and not an endogenous variable in the bargaining process.

2 The current state of the labour market may also affect labour's willingness to strike or be locked out (see Eckstein and Wilson, 1962).

Third, "standards of fairness" (bargaining demands) must be specified. From labour's perspective, two "demands" will likely dominate:

i) the maintenance of labour's real standard of living, and

ii) the expectation of a wage settlement which is roughly comparable to settlements received by "similar" groups of workers.

The first demand would clearly encompass past expectational errors concerning future inflation rates as labour (or the firm) would not want to bear the permanent risk of unexpected changes in the real wage (see Section III). In addition, individual groups may be very defensive about relative wage patterns. An "equitable" division of the bilateral monopoly surplus (which will preserve the lasting relationship) will likely be strongly influenced by wage settlements recently obtained by other (similar) workers. As pointed out above, intense bargaining may be required to clarify which previous settlements are appropriate standards of fairness, and what proportion of these earlier settlements should "spill into" a given wage settlement.

In summary, two different economic approaches to wage spillovers have been suggested: (i) shifts in the supply curve of labour for a given firm (Marshallian-Phelps) and (ii) the preservation of long-run firm-labour relationships (Okun, Gordon, Tobin). In fact, one might argue that the bargaining process within the "implicit contractual approach" is simply a surrogate for the dissemination of relative wage effects which are part of a micro Marshallian-Phelps model. Furthermore,

both approaches may generate a "set of spillover" variables which would closely resemble those suggested by a pure institutionalist model. Unfortunately, "econometric technology" may not be able to discriminate amongst these approaches.[1] As pointed out above, the "economic" spillover effects are additional determinants of micro wages, and do not replace the traditional set of explanatory variables. However, the conventional "expected price" Phillips curve should be amended to include a direct correctional mechanism for past price expectational errors. In addition, the "implicit contractual" view of labour markets suggests that the effects of excess demand/supply of labour (the Phillips curve effect) are likely much less pronounced than previously thought.

Before estimating a spillover model, one must specify which previous settlements are to be included as additional explanatory variables. The approach of this paper is to confine the spillover concept to a "given labour market" as defined by industry affiliation and geography.[2] The previous (annualized) wage settlement in the same industry ($\dot{W}_{S1C}$) is employed to reflect specific industry spillover effects.[3] For example, it is postulated that the previous wage settlement

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1 For further discussion of this "identification" problem, see Addison and Burton (1976).

2 Data for occupation, a third possible dimension to the labour market, do not exist.

3 Industrial sectors are defined in Table 1, and "previous" industry settlements are restricted to those which occur in the same province.

in the "beverage" industry will affect the next wage negotiation within the "beverage" industry. In addition, the previous wage settlement within the local geographical labour market ($\dot{W}_{LM}$) is also expected to influence a given wage negotiation. To define local labour markets, geographical boundaries established by the Statistics Canada Labour Force Survey are employed. Both spillover effects are assumed to be reflected in the "single" previous settlement,[1] as defined above.

Table 4 presents the results for the model enlarged to include both spillover variables. Since the price catchup variable is always significant, only the combined "price expectations-price catch-up-spillover" Phillips curve estimates will be discussed. In all cases the two spillover variables are individually significant, with the industry spillover approximately twice the size of the local labour market spillover. In terms of over-all goodness-of-fit, there is very little to choose between the final four equations. For the first time, all labour market variables are correctly signed with both the vacancy rate and the prime-aged male unemployment rate effect being significantly different from zero. The role of ex ante future price expectations continues to be relatively minor. In fact, in the vacancy equation, the effect of future price expectations is not significantly different from zero. As found in Section III, the variable which measures "past uncompensated inflation" (catch-up) remains the dominant explanatory factor in the wage determination process.

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[1] A subsequent project, still in progress, examines various "distributions" of past settlements.

TABLE 4

WAGE "SPILLOVER" ESTIMATES

	Constant	$\dot{P}^{e}$	$\dot{P}^{cu}$	$\dot{W}_{SIC}$	$\dot{W}_{LM}$	U^{-1}	U_{pm}^{-1}	V	S.E.E	$\bar{R}^2$
(13)	1.20	.585		.338	.162	1.52			2.624	.537
	(2.67)	(13.45)		(11.87)	(5.57)	(.78)				
(14)	1.12	.578		.338	.162		1.69		2.624	.537
	(2.71)	(13.12)		(11.89)	(5.58)		(1.08)			
(15)	2.06	.654		.333	.155			-1.14	2.623	.537
	(4.44)	(9.35)		(11.63)	(5.28)			(1.25)		
(16)	1.13	.101	.623	.321	.162	2.31			2.449	.596
	(2.69)	(2.50)	(17.82)	(12.51)	(6.23)	(1.26)				
(17)	.76	.082	.624	.322	.163		3.61		2.445	.598
	(1.94)	(1.99)	(18.05)	(12.59)	(6.25)		(2.42)			
(18)	1.00	.039	.607	.319	.164			1.27	2.449	.596
	(2.24)	(.61)	(16.23)	(12.45)	(6.28)			(1.50)		
(19)	.83		.608	.319	.166			1.61	2.449	.597
	(2.52)		(16.57)	(12.23)	(6.36)			(2.79)		

To determine the "equilibrium" effects of the spillover variables (i.e. the "total" effect after the spillovers have permeated throughout the system), it is assumed that there are a sufficient number of previous wage settlements (in each quarter) to allow the system to come to rest for a given set of non -spillover explanatory variables (prices and vacancy rates). The equilibrium counterpart of equation (19) can be represented in the following form:[1]

$$(19A) \qquad \dot{W} = 1.61 + 1.18\,\dot{P}^{cu} + 3.13\,V$$

Comparing equation (19A) to (12), one notes the obvious increases in the coefficients for the vacancy rate and the price effect (which now clearly exceeds unity). Chart VI presents short-run Phillips curves for equation (12), the "no spillover" model, and for equation (19A), the "equilibrium spillover" model (assuming a fully anticipated 5% price inflation rate and utilizing both UV curves). The inclusion of wage spillovers has clearly shifted the short-run Phillips curve out to a substantially higher (and more adverse) position, and modestly increased the slope of the short-run trade-off curve.

While further implications of the wage spillover model will be discussed in the final summary section of the paper, an analysis of the short-run versus long-run aspects of the implied Phillips curve cannot be postponed. The statistical results of Table 4 suggest that there is a statistically significant, but fairly flat, short-run Phillips curve.

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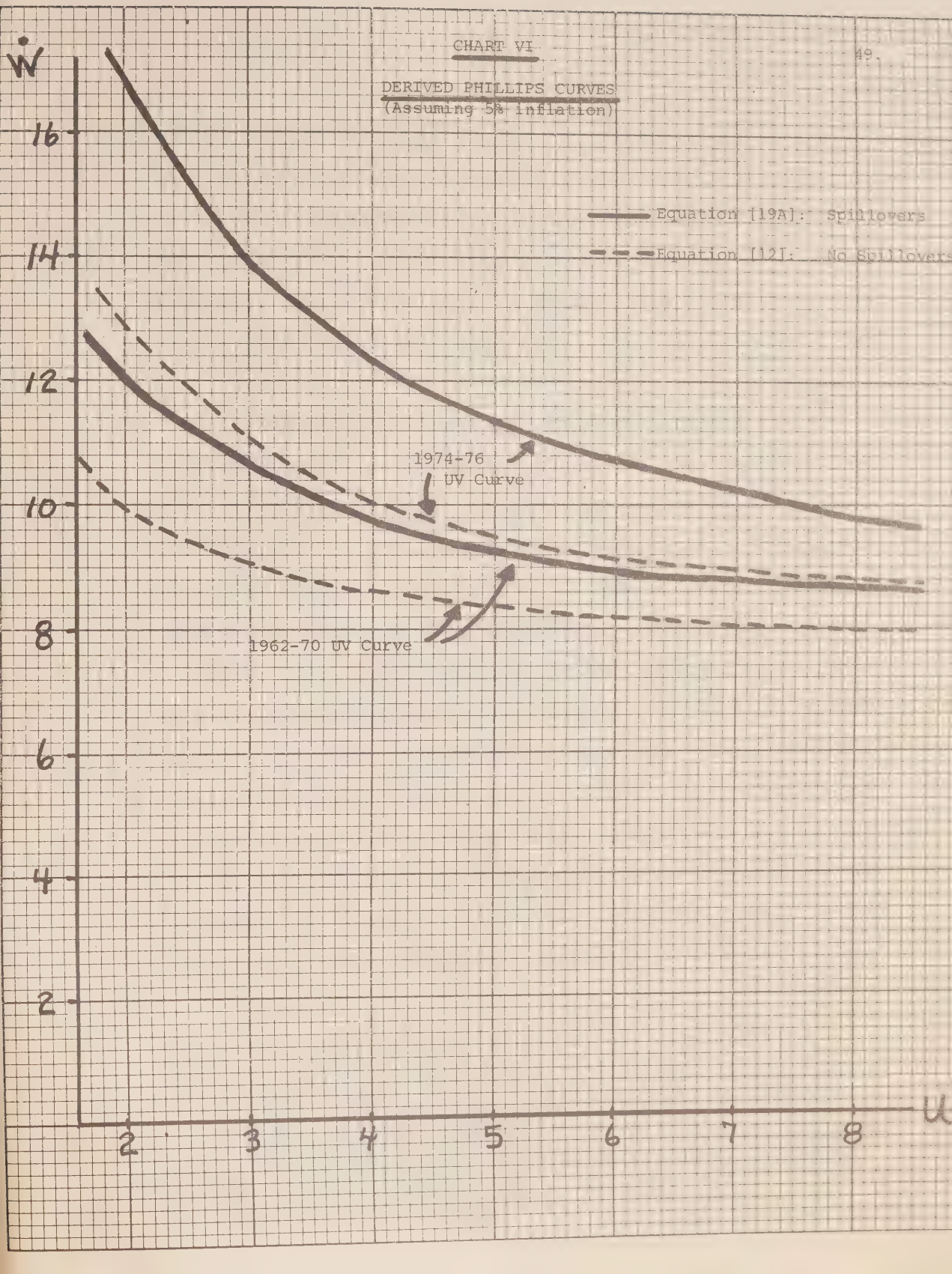
[1] All $\dot{W}$'s are assumed to be of identical value, and the regression coefficients are scaled by the reciprocal of [1.0 - .319 - .166]. Note equilibrium refers only to wage feedbacks, and not price feedbacks.

CHART VI

DERIVED PHILLIPS CURVES
(Assuming 5% inflation)



However, no long-run Phillips curve exists [the critical price coefficient is taken to be unity in equation (19A)] as the long-run[1] Phillips curve is perfectly vertical at the natural rate of unemployment. Using equation (19A), the natural rate of unemploymnet, i.e. the rate of unemployment which will be accompanied by sustained, constant inflation (say 0%), is approximately 7-1/2 - 8% in the Canadian manufacturing sector during the 1974-76 period.[2]

The macroeconomic policy implications are discouraging, and worth repeating. Many would regard 7-1/2 to 8% as an intolerably high unemployment rate. Furthermore, the short-run costs of a lower unemployment rate may be quite modest. Demand management policies which move the economy leftward on the relatively flat short-run Phillips curve will have only minor immediate inflation costs (most of labour is locked-in to a given wage contract) and perhaps substantial employment effects. However, the long-run consequences of this short-run expansionary policy are non -trivial. Since there is no long-run Phillips curve, any attempt to hold the economic system at an unemployment rate below the natural rate will only lead to accelerating price inflation. Even if the economic system were to return to the natural rate of unemployment, this "modest" amount of short-run Phillips curve inflation will persist indefinitely as the Phillips curve would permanently shift up (given the

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1 It is beyond the scope of this paper to provide "estimates" for "how long is the long run?", although the reader is reminded that the average wage contract exceeds two years and is typically three years in length (for the Canadian manufacturing sector).

2 For the 1960's UV curve, the natural rate of unemployment is approximately 4%. These calculations assume that consumer price changes move one-to-one with manufacturing price changes and that the growth rate of the productivity within the manufacturing sector is approximately 4% (see Section III).

higher rate of price inflation). The only way to purge this modest short-run inflation from the economy is to impose restrictive demand management policies which create unemployment in excess of the natural rate of unemployment. In other words, policy forays into the low unemployment region of the short-run Phillips curve must be countered by a subsequent dose of restrictive demand management policy. Failure to take the policy antidote (unemployment in excess of the natural rate for a comparable period of time) will result in cumulative short-run inflationary episodes. Past expansionary policies with individually modest inflationary consequences will continue to live on, casting a cumulative inflation rate shadow.[1] Again, to purge this (cumulative) inflation rate from the economy requires a cumulative dose of restrictive policies. Unfortunately, the restrictive counter policy will take effect very slowly as the flatness of the Phillips curve provides very little short-run leverage on the wage inflation rate.

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[1] To paraphrase an earlier theoretical argument of this paper, "policy bygones are not bygones" as inflationary policy mistakes of the past will continue into the future unless offset by deliberate counter restrictive policies.

V. Summary and Conclusions

A number of important empirical, theoretical, and policy conclusions emerge from this study. First, the influence of consumer prices in the wage determination process may be quite different than typically assumed. The "micro" data results of Tables 3 and 4 strongly suggest that future ("ex ante") price expectations are a relatively minor factor in wage bargaining in contrast to the dominant role assigned to recapturing past, uncompensated inflation (an "ex post" price effect). Price inflation remains a very strong determinant of wages;[1] but the large proportion of the price effect follows, not leads, actual movements in product prices. It is not rising price expectations which matter, but rather actual historical movements in consumer prices. Since wage negotiations are relatively immune from expectations of future inflation, policy directed towards reducing "rising" (price) expectations will have little effect on wages unless such policies actually reduce consumer price levels directly, and then the wage effect will follow with a long lag. It is also interesting to note that the failure to include this critical, significant uncompensated past inflation ("price catchup") variable produces a major econometric specification bias. The short-run "Phillips curve effect" is only present when this variable is included. As pointed out in the text, this "catch-up" variable is dynamic, non-linear and highly dependent upon the lengths of successive wage contracts. It cannot be approximated by a simple distributed lag on past prices (the usual price expec-

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[1] The combined coefficients of the two price effects are very close to unity throughout the study (we return to this point at a later stage in the conclusions).

tations specification), nor can aggregation to quarterly time-series be readily accomplished.

Secondly, "spillovers" from previous settlements are highly significant additional determinants of wage changes. As pointed out in Section IV, there are cogent economic reasons for the existance of wage spillovers at the micro level. Results presented in Table 4 suggest that 32% of the annual wage change from the previous negotiation in the same industry will "spill into" the next industry wage settlement, and 16% of the annual wage change from the previous negotiation within the same local geographic labour market will "spill into" the next local wage settlement. In other words, almost one half of the wage bargain can be attributed to previous wage settlements with the other half of the wage bargain being attributable to consumer prices (catchup) and a labour market pressure variable (with both of these latter variables remaining highly significant factors). At the micro level, wage spillovers clearly matter; but do not replace the traditional determinants of wages. The one exception to this last statement is the total demise of "ex ante" price expectations, presumably being replaced by "ex post" inflation adjustments and wage expectations (reflected in the spillover variables).

From a policy perspective, these wage spillovers introduce a crucial interdependency within the wage system. Previous wage settlements will now permeate throughout the system, providing a certain momentum to the wage inflation process. Such interdependencies suggest that any change in policy, say an "engineered" increase in unemployment, will take longer to affect wage settlements as previous wage bargains (which were based on the "old" levels of unemployment) will continue to affect current wage settle-

ments (by about 50%) despite the "new economic conditions". The system has a certain degree of momentum on its own. Furthermore, any random shock, say an inexplicably large settlement, will likewise affect other wage bargains (via the spillover variables). Thus, not only do these spillover interdependencies generate a certain degree of momentum to the wage determination process, the entire wage system may be quite fragile in the sense that random shocks are translated into systematic wage movements ("equalizing pattern settlements" to the I.R. expert, "autocorrelated errors" to the econometrician). However, it is important to recall that basic economic variables (price and labour market effects) still provide more than half of the short-run determination of wages, and all of the long-run determination. Spillovers affect the short-run dynamics of the system, a non-trivial issue for policy maker, as well as the long run "steady state" properties of the wage system.

Before analyzing the "long-run" properties of the interdependent wage system, it is useful to review the short-run "Phillips curve" estimates. When correctly specified, a labour market pressure variable significantly affects wage settlements. However, the unemployment rate, the traditional proxy for excess labour demand/supply, does not perform satisfactorily in all versions of the Phillips curve presented in this paper; and, consequently, has been replaced by an alternative measure of labour market pressure, the help wanted index. This latter variable is correctly signed and highly significant in the wage equation estimates presented in Tables 3 and 4. To derive a "conventional" short-run Phillips curve from the wage equations presented in this paper, a UV curve is utilized to translate the wage-vacancy relationship into a wage-unemployment relationship. As pointed out in Section III, the

Canadian UV curve has dramatically shifted in the early 1970's, resulting in two distinct Phillips curves. The more recent short-run Phillips curve, based on the 1974-76 UV curve, has a much higher (and more adverse) position than the Phillips curve of the 1960's. In both cases, the short-run Phillips curve is relatively flat with only small changes in wage settlements arising from substantial variations in the unemployment rate. The existence of wage spillovers, and the implied interdependency of the wage system, provide a further outward shift in the Phillips curve (see Chart VI). Consequently, wage spillovers adversely affect the short-run momentum of the wage determination process as well as the longer-run properties of the economic system. Within this interdependent wage spillover system, higher rates of wage inflation must be tolerated for given levels of unemployment.

While this study has only concerned itself with the structure of the wage equation (to the complete neglect of price and labour market structural equations), the macroeconomic policy implications are clear. There is a Phillips curve in the Canadian manufacturing sector, but it is a rather discouraging one. The 1970's version of the Phillips curve suggests that wage settlements are only marginally affected (in the short-run) by changing unemployment levels as a full two point movement in the unemployment rate produces only a one percent change in wage settlements. Finally, the evidence presented in this paper suggests that the long run trade-off curve may be vertical at an (intolerably) high rate of unemployment. Thus, demand management policies may offer little promise in simultaneously coping with the two major macroeconomic evils of inflation and unemployment as the "macro" policy maker may be faced with the worst of all possible worlds:

very little short-run leverage on the inflation rate, no longrun trade-off and an intolerably high (natural) rate of unemployment. In such a world, the application of general macroeconomic policies will not solve the fundamental structural (microeconomic) problems of the economy.

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